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ELECTROCONDUCTIVE CONCRETE ELECTRIC HEATING APPLIANCE

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ELECTROCONDUCTIVE CONCRETE ELECTRIC HEATING APPLIANCE

[Daodian huningtu shong diannuan zhuang zhi]

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[There are no amendments to this patent.]

Claims

1. An electroconductive concrete electric heating appliance comprised of four main parts, that is, electroconductive concrete heating body (1), electrode (2), heating control appliance (3), and insulating material (4).

2. The electroconductive concrete electric heating appliance described in Claim 1 characterized by the fact that the electroconductive concrete material used for said electroconductive concrete heating body (1) contains at least graphite powder or carbon fiber.

3. The electroconductive concrete electric heating appliance described in Claim 1 characterized by the fact that said electrode (2) is any type of electrode selected from a metallic electrode, graphite electrode, carbon fiber bundle electrode, and carbon fiber fabric electrode.

4. The electroconductive concrete electric heating appliance described in Claim 1 characterized by the fact that said heating control appliance (3) is a cascade resistance type potential-dividing controller or a PTC electronic ceramic controller.

5. The electroconductive concrete electric heating appliance described in Claim 1 characterized by the fact that said insulating material (4) is at least one type selected from concrete, tile, glass, mica paper, and iron plate with sintered enamel.

6. The electroconductive concrete electric heating appliance described in Claim 1 or 2 characterized by the fact that the electroconductive concrete heating body used is precast electroconductive concrete.

7. The electroconductive concrete electric heating appliance described in Claim 1 or 2 characterized by the fact that an electroconductive concrete heating body integrated with a wall or the ground is formed by casting electroconductive concrete mortar on site.

8. The electroconductive concrete electric heating appliance described in Claim 1 or 2 characterized by the fact that the carbon fiber used is one type selected from chopped carbon fiber, carbon fiber net, carbon fiber bundle, and carbon fiber fabric with an average length of at least 2-12 mm.

9. The electroconductive concrete electric heating appliance described in Claim 1, 2, or 3 characterized by the fact that the electrode used is adhered to the electroconductive concrete heating body using at least a conductive adhesive or electroconductive concrete mortar.

Specification

The present invention pertains to an electric heating appliance using electroconductive concrete as the electric heating body.

The two current main central heating systems are a steam or hot water heating and electric heating systems. A steam or hot water heating system requires setting up steam pipelines, hot water pipelines and radiating fins, which affect the appearance of a residential area. Also, smoke and dust generated by coal burning furnaces used in most of the heating systems are directly released into the air without being treated and pollute the environment. A central air-conditioning system is usually adopted in an electric heating system. Because of its high price, it can only be used in office buildings and luxurious hotels, while common residential buildings, normal offices, and factory buildings are unable to afford such a heating system.

In addition to a central heating systems, many people who live in cities or towns use coal furnaces, which use honeycomb briquettes or egg-shaped briquettes as fuel, for heating. These coal furnaces not only bring dust pollution to a residential area but also cause air pollution because of the significant amount. A used coal furnace tends to cause carbon monoxide poisoning when ventilation or smoke discharge is blocked.

In order to solve the heating problem for people who have not benefited from central heating systems, various types of electric heaters have been developed. Examples of these electric heaters include oil-filling electric heaters, infrared electric heaters, hot air electric

heaters, hanging type all-plastic electric heaters, etc. An oil-filling electric heater usually uses polychlorinated biphenyl, which is a toxic substance that is difficult to decompose. The temperature of the surface heating elements of an infrared electric heater is in the range of 600-900°C. An infrared electric heater has open fired and overheated areas, and its configuration is also complicated. A hot air electric heater has high energy consumption and is noisy. A hanging type all-plastic electric heater has short service life since its plastic material will age quickly under heating over time. Chinese patent No. 93107944.6 disclosed a type of electric heating floor brick, in which graphite powder and a metal powder are adhered to each other via a resin. However, since the metal powder is oxidized quickly under continuous heating to change its electroconductivity, the heating effect is affected. The resin also ages to shorten the service life. Chinese Patent No. 93101346.1 disclosed an ionic heater with a carbon graphite electrode anticreep structure, which adopts electrification through an electrolyte aqueous solution for heating. However, its electricity-to-heat conversion rate is relatively low, and the manufacturing process is complicated.

In addition, central heating facilities as well as coal furnaces and electric heaters have a common disadvantage, that is, they require a certain spatial area.

The purpose of the present invention is to solve the aforementioned problems.

The present invention provides an electroconductive concrete electric heating appliance comprised of four main parts, that is, an electroconductive concrete heating body, an electrode, a heating control appliance, and an insulating material. In the following, the present invention will be explained in more detail with reference to examples shown in figures. To facilitate the description, the symbols of various parts in Figures 1-6 are unified as follows.

Symbol	Name
<1>	Electroconductive concrete heating body
<2>	Electrode
<3>	Heating control device
<4>	Insulating material
<5>	Concrete wall or floor surface
<6>	PTC electronic ceramic piece
<7>	Metal piece
<8>	Fixing screw or bolt
<9>	Threaded hole

I. The present invention uses electroconductive concrete as the electric heating body. The electroconductive concrete used for this heating body contains at least one substance selected

from graphite powder and carbon fiber. The carbon fiber can be chopped carbon fiber, carbon fiber net, carbon fiber bundle, or carbon fiber fabric with an average length of at least 2-12 mm or their combination.

Since both graphite powder and carbon fiber have good chemical inertness and thermal stability, service life and stable properties of the electroconductive concrete can be guaranteed.

Electroconductive concrete heating body <1> can be integrated with a wall (see Figure 1-a) or a floor (see Figure 1-b) during construction so that central heating can be realized without occupying extra space. It is also possible to manufacturing precast concrete - electroconductive concrete heating plate (Figure 2) to meet the market demand. Figure 1-c is a diagram illustrating the wiring connection of the main parts in the electroconductive concrete electric heating appliance.

II. The electrode connected to the two ends of the electroconductive concrete in the present invention can be any type of electrode selected from a metallic electrode, graphite electrode, carbon fiber bundle electrode, and carbon fiber fabric electrode.

Electrode (2) can be adhered to the electroconductive concrete using an electroconductive adhesive (see the design of the electroconductive concrete heating plate shown in Figure 2). It can also be directly cast between the two ends of the electroconductive concrete (Figures 1-a, 1-b) when the electroconductive concrete heating body is cast from a electroconductive concrete mortar. In other words, it is also possible to adhere the electrode with the electroconductive concrete mortar.

III. The heating control device used in the present invention can be a cascade resistance type potential-dividing controller or a PTC (positive temperature coefficient) electronic ceramic controller.

Heating control device (3) controls the heating rate of the electroconductive concrete heating body by controlling the voltage applied to the two ends of the electroconductive concrete heating body. A cascade resistance type potential divider needs manual adjustment, while a PTC electronic ceramic controller (Figures 3, 4) can automatically control within a set temperature range. When the temperature of the heating body is lower than the set temperature, since the PTC electronic ceramic resistance is very low, the voltage applied to the electroconductive concrete heating body becomes high. At that time, the heating rate and temperature-increase rate are relatively high.

When the temperature reaches the set temperature (Curie point temperature of PTC electronic ceramic), the electric resistance of the PTC electronic ceramic increases significantly, leading to a drop in the voltage applied to the two ends of the electroconductive concrete heating body. As a result, the heating rate is reduced. When the temperature drops below the set temperature, the resistance of the PTC electronic ceramic decreases significantly, leading to an

increase in the voltage applied to the two ends of the electroconductive concrete heating body. As a result, the heating rate is increased. In this way, heating of the electric heating appliance can be controlled automatically, and electric energy can be saved.

For a PTC electronic ceramic controller, one side of a PTC electronic ceramic piece can be directly adhered to electrode <2> with a conductive adhesive, while the other side is adhered to a metal piece, which is connected to a wire (Figure 3). It is also possible to adhere the two sides of PTC electronic ceramic piece <6> to two metal pieces <7>, respectively. One of the metal pieces <7> is connected to a wire, while the other is fixed with metal screw <9> to electrode <2> (Figure 4).

IV. The insulating material used in the present invention can be concrete, tile, glass, mica paper, or iron plate with sintered enamel on the surface, or their combination.

In spite of their good electric insulating property, plastics and rubber materials cannot be used because they will age easily under heating. Asbestos material cannot be used, either, because of its carcinogenic effect even though it can reduce the cost.

For electroconductive concrete <1> that is integrated with wall (Figure 1-a) or floor (Figure 1-b) during construction, it is possible to lay a thin layer of concrete on the surface of the electroconductive concrete and then stick tiles as insulating material <4> on it. In this way, it is also possible to decorate and beautify a house. For an electric heating appliance using a precast electroconductive concrete plate, it is possible to wrap the surface of the heating body with mica paper (4a in Figure 2) and fix this on the wall of a room by using an iron plate frame with sintered enamel (4b in Figure 2) as well as fixing screws or bolts. Mica paper (4a) and enamel iron plate frame (4b) have an insulating effect. The latter also acts as the housing of the heating body. It is possible to burn various types of patterns on the surface of the enamel iron plate frame for decoration and beautification.

The enamel iron plate frame should be arranged closely in the structure to the precast electroconductive concrete plate such that the enamel iron plate frame is closely bonded to the electroconductive concrete heating body wrapped with the mica paper with no space between them. In this way, the heat generated by the heating body can be radiated quickly through the enamel frame to improve the heating efficiency. Since the thickness of the mica paper is very small, the design depth of the enamel iron plate frame is consistent with the thickness d of heating body <1>. The width of electrode <2> should be a little smaller than or equal to the thickness of the heating body, as shown in Figures 5-a and 5-b.

For easy maintenance, it is possible to form two small openings with lids on the iron plate frame in an area close to an electrode or the wire connecting area as shown in Figure 6.

A ground wire is connected between the electric heating appliance of the present invention and the electrode for extra safety and a protection effect. Since after the temperature of

the electroconductive concrete heating body reaches the set temperature, the voltage applied to the two ends of the electroconductive concrete heating body is very low, that is, about 1/10 of the power supply voltage or even less, the potential of the entire electroconductive concrete heating body is in a safe range at this working temperature, as shown in Figure 3.

The connection methods for the PTC electronic ceramic controller and electrode mentioned in the present invention, the opening design for the enamel frame, and the design of ground wire connection are not included in the patent application.

The present invention has the following advantages. Electroconductive concrete is used as the electric heating body and can be combined effectively with the construction structure (floor or wall) so that there is no need to occupy extra space or affect the appearance of the house. This is a clean and economical electric heating appliance with long service life, high heat efficiency, stable performance, simple structure, and easy installation and manufacture.

It can be manufactured as a central heating system in the construction process. It is also possible to use precast electroconductive concrete to manufacture a hanging type electric heater to satisfy a market demand. In addition, since the electroconductive concrete can be combined with the wall or floor of a construction, it is possible to provide a very large heating area and control it effectively with the aid of a temperature control system. Consequently, this electric heating appliance can also be used as a drying system for drying house and storage warehouse. In particular, great loss can occur since grain is mildewed during storage due to mold generated in a humid environment. If the floor and the walls of a grain warehouse can be designed as an electric heating device using electroconductive concrete, the grain can be dried at any time, and the conditions for generating mold can be reduced. Since mold usually first occurs on the floor and walls that have contact with the grain, when the floor and walls become heating bodies, the temperature is high enough to kill various types of mold growing on the floor and the walls.

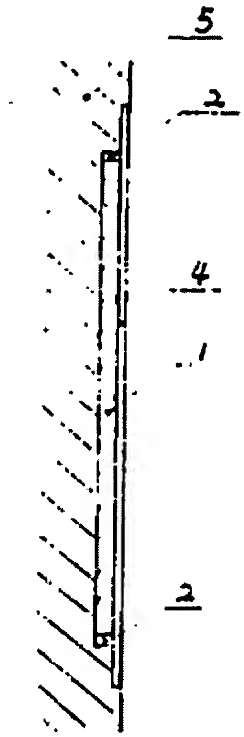

Figure 1-a

Figure 1-b

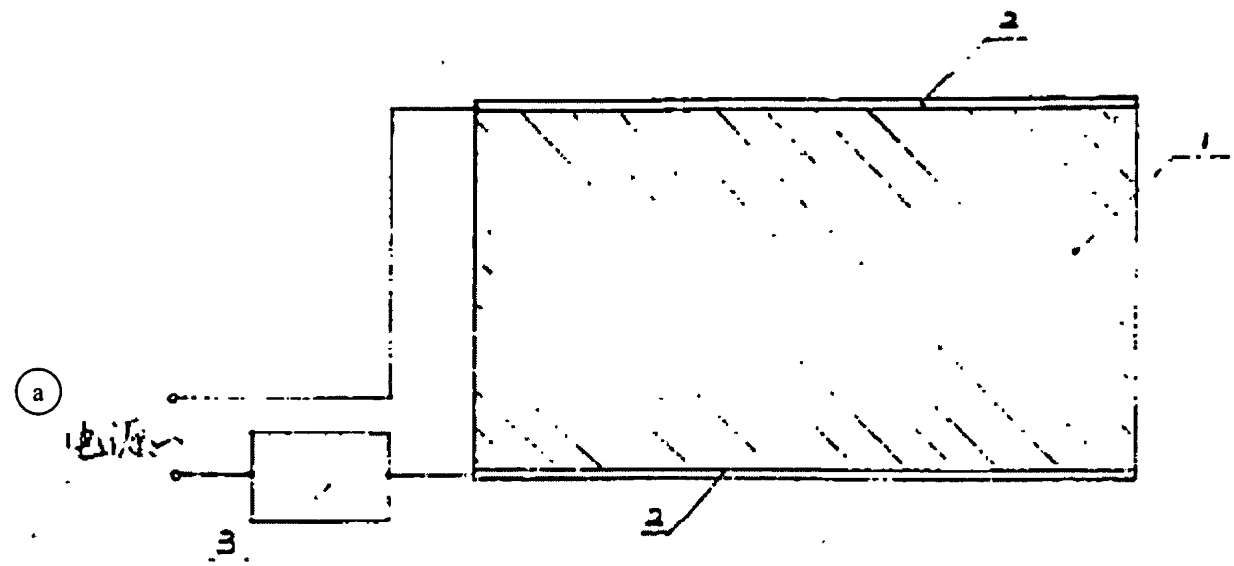

Figure 1-c

Key: a Power supply

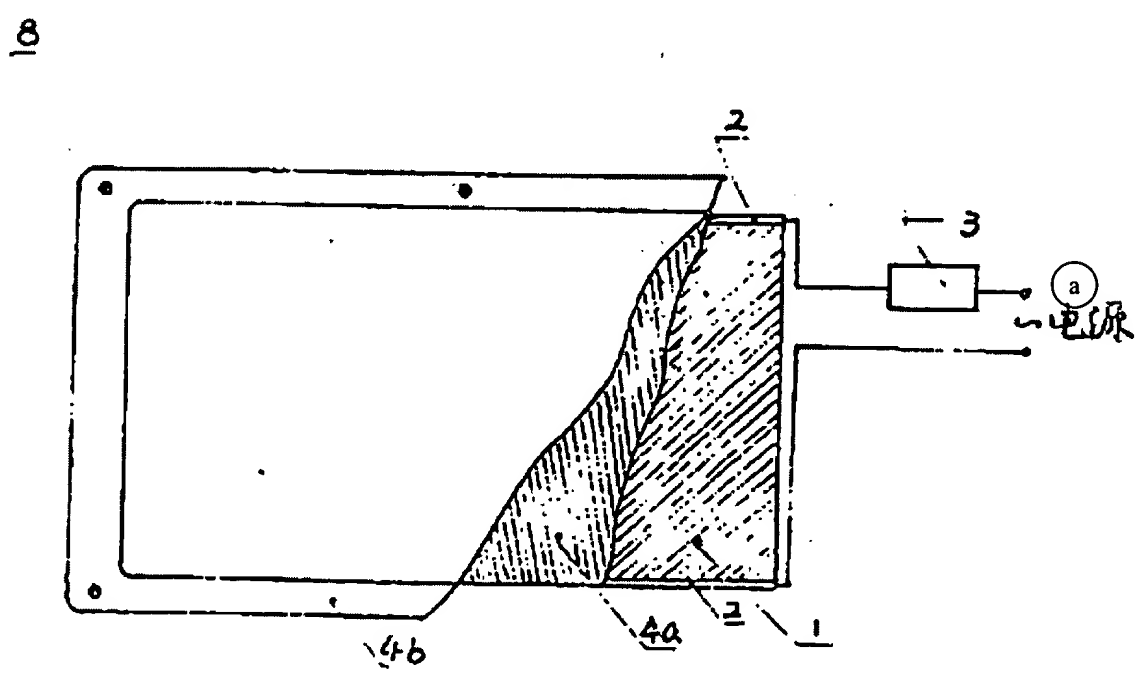

Figure 2

Key: a Power supply

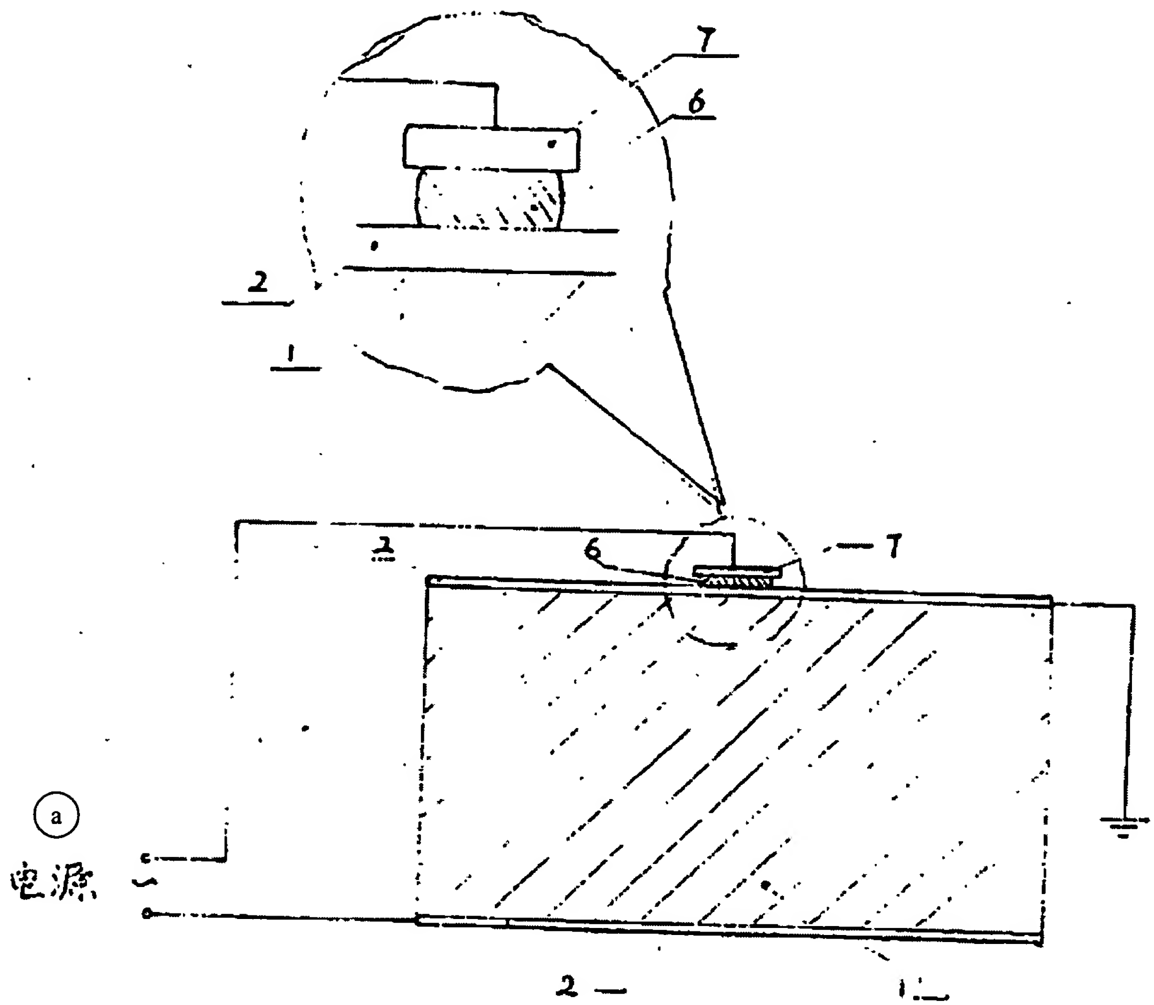

Figure 3

Key: a Power supply

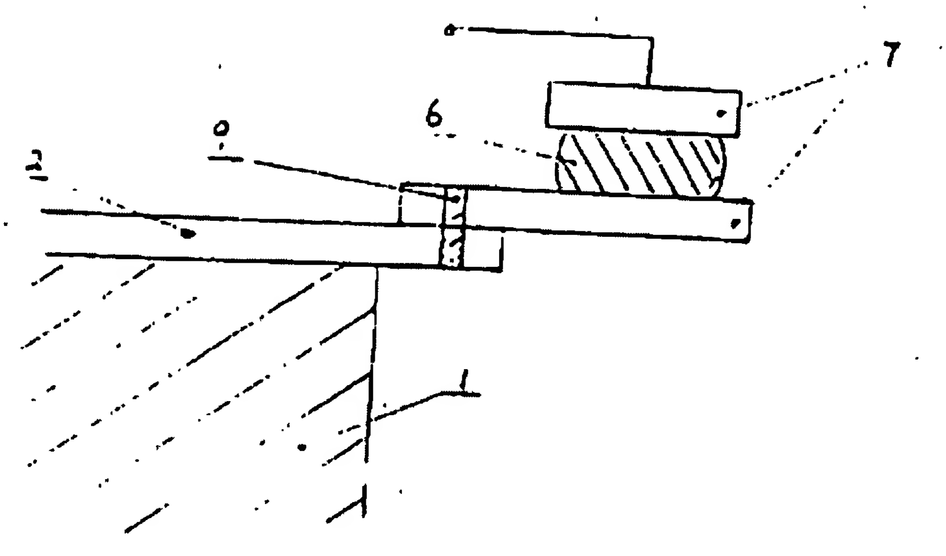

Figure 4

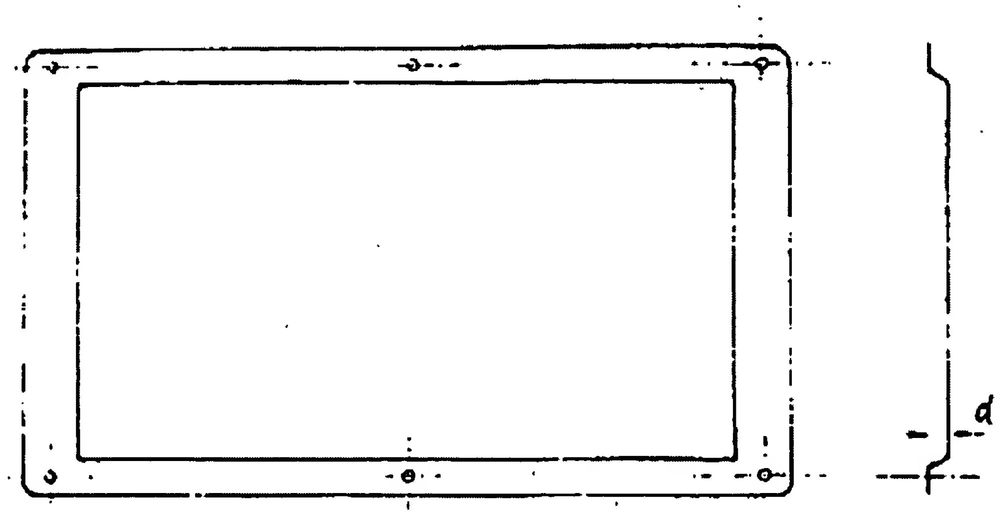

Figure 5-a

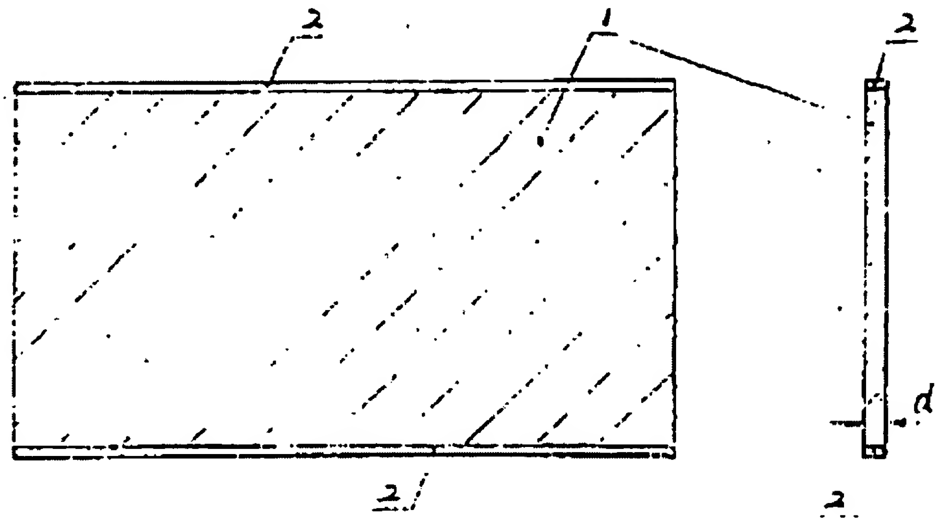

Figure 5-b

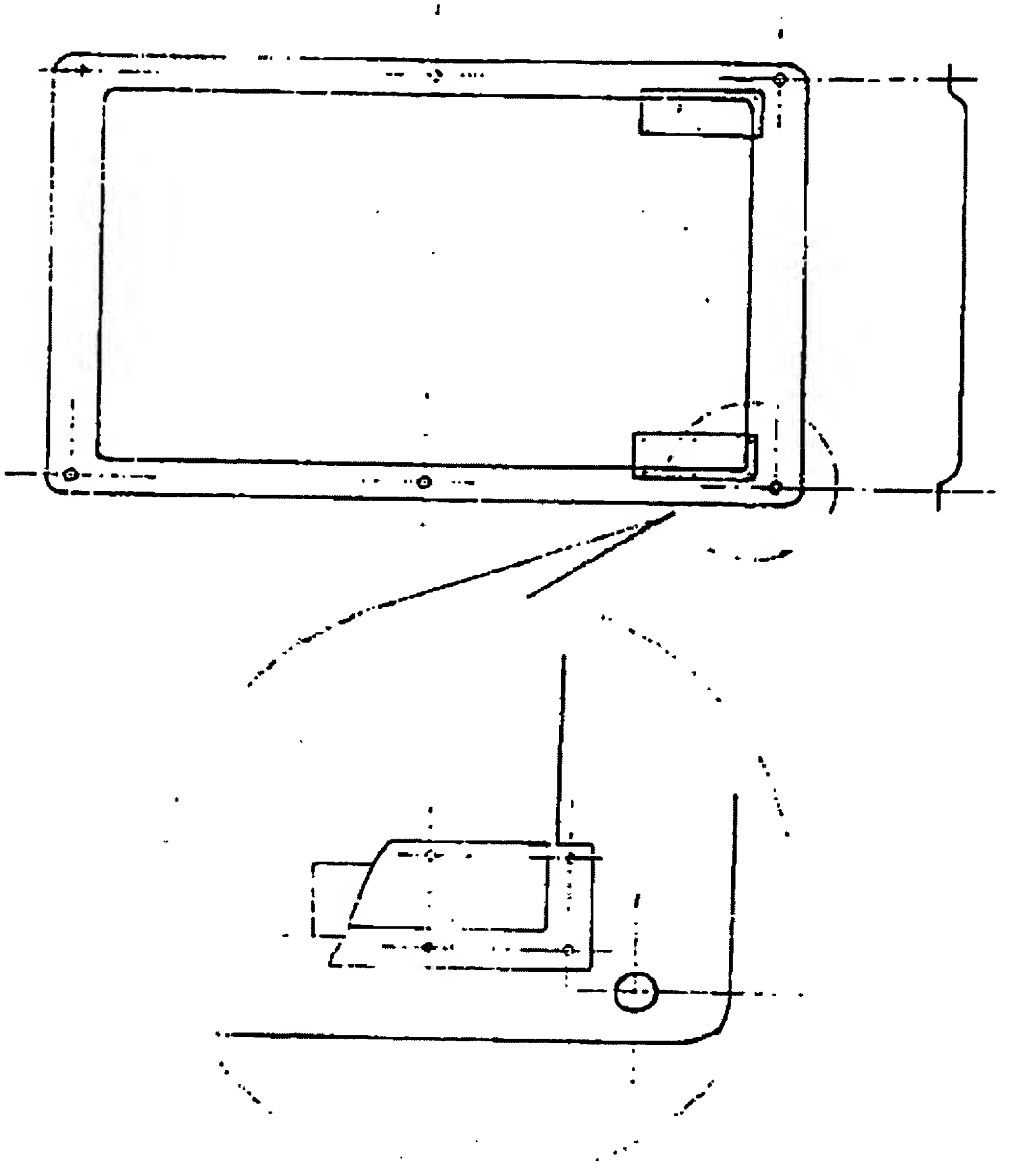

Figure 6